

# SEQUENCE LISTING

<110> MENZEL, ROLF

<120> COMPOSITIONS AND METHODS FOR DIRECTED GENE ASSEMBLY

<130> 10424-003

<150> 60/222,134

<151> 2000-07-31

<160> 22

<170> PatentIn version 3.0

<210> 1

<211> 87

<212> DNA

<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 1

aattcgcggt taaacttaat taaggtagcc attttttggc agatctagac caaaaaatgg 60  
gggcggccgc tccccgggtg gcgcgcc 87

<210> 2

<211> 87

<212> DNA

<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 2

aattggcgcg ccacccgggg agcggccgcc cccatttttt ggtctagatc tgccaaaaaa 60  
tgggtacctt aattaagttt aaacgcg 87

<210> 3

<211> 50

<212> DNA

<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 3

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<210> 4

<211> 50

<212> DNA

<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 4  
ccaggtttga gcagccgcgt agtgaaatct atatctatga tctcgcagtc 50

<210> 5  
<211> 87  
<212> DNA  
<213> Artificial

<220>  
<223> Description of artificial sequence: Primer

<400> 5  
aatttaccat ggagcaattg catatgggtt aaacagctcg agtagatctt gcggccgctt 60  
ggctagcgtc agctgggtac catgcat 87

<210> 6  
<211> 87  
<212> DNA  
<213> Artificial

<220>  
<223> Description of artificial sequence: Primer

<400> 6  
cgcggttatgc atggtaccca gctgacgcta gccaaagcggc cgcaagatct actcgagctg 60  
tttaaaccat atgcaattgc tccatgg 87

<210> 7  
<211> 19  
<212> DNA  
<213> Artificial

<220>  
<223> Description of artificial sequence: Primer

<400> 7  
cgcaawcygt tccttaygg 19

<210> 8  
<211> 20  
<212> DNA  
<213> Artificial

<220>  
<223> Description of artificial sequence: Primer

<400> 8  
gccaggagcc atsacwtcaa 20

<210> 9  
<211> 28  
<212> DNA  
<213> Artificial

<220>  
<223> Description of artificial sequence: Primer

<400> 9

ggggtaccgc ggtctattca tactttcg

28

<210> 10  
<211> 36  
<212> DNA  
<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 10  
gcagatctca tttgtagaa tatgttattg agcggc

36

<210> 11  
<211> 27  
<212> DNA  
<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 11  
agcgagatct ctattattgt gcagctg

27

<210> 12  
<211> 33  
<212> DNA  
<213> Artificial

<220>

<223> Description of artificial sequence: Primer

<400> 12  
gcgcggtacc tgataaaagg agagggtaaa gag

33

<210> 13  
<211> 1140  
<212> DNA  
<213> Bacillus licheniformis

<220>

<221> CDS

<222> (1) .. (1140)

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atg atg agg aaa aag agt ttt tgg ctt ggg atg ctg acg gcc tta atg  
Met Met Arg Lys Lys Ser Phe Trp Leu Gly Met Leu Thr Ala Leu Met  
1 5 10 15  
ctc gtg ttc acg atg gcc ttc agc gat tcc gcg tct gct gct cag ccg  
Leu Val Phe Thr Met Ala Phe Ser Asp Ser Ala Ser Ala Ala Gln Pro  
20 25 30  
gcg aaa aat gtt gaa aag gat tat att gtc gga ttt aag tcg gga gtg  
Ala Lys Asn Val Glu Lys Asp Tyr Ile Val Gly Phe Lys Ser Gly Val  
35 40 45  
aaa acc gca tcc gtc aaa aag gac atc atc aaa gag agc ggc gga aaa  
Lys Thr Ala Ser Val Lys Lys Asp Ile Ile Lys Glu Ser Gly Gly Lys  
50 55 60

48

96

144

192

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| gtg | gac | aag | cag | ttt | aga | atc | atc | aac | gcg | gca | aaa | gcg | aag | cta | gac | 240  |
| Val | Asp | Lys | Gln | Phe | Arg | Ile | Ile | Asn | Ala | Ala | Lys | Ala | Lys | Leu | Asp |      |
| 65  |     |     |     |     | 70  |     |     |     | 75  |     |     |     |     |     | 80  |      |
| aaa | gaa | gcg | ctt | gag | gaa | gtc | aaa | aat | gat | ccg | gat | gtc | gct | tat | gtg | 288  |
| Lys | Glu | Ala | Leu | Glu | Glu | Val | Lys | Asn | Asp | Pro | Asp | Val | Ala | Tyr | Val |      |
|     |     |     | 85  |     |     |     |     |     | 90  |     |     |     |     | 95  |     |      |
| gaa | gag | gat | cac | gta | gct | cat | gct | ttg | gcg | caa | acc | gtt | cct | tac | ggc | 336  |
| Glu | Glu | Asp | His | Val | Ala | His | Ala | Leu | Ala | Gln | Thr | Val | Pro | Tyr | Gly |      |
|     |     |     | 100 |     |     |     |     | 105 |     |     |     |     | 110 |     |     |      |
| att | cct | ctc | att | aaa | gcg | gac | aaa | gtg | cag | gct | caa | ggc | tac | aag | gga | 384  |
| Ile | Pro | Leu | Ile | Lys | Ala | Asp | Lys | Val | Gln | Ala | Gln | Gly | Tyr | Lys | Gly |      |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |      |
| gcg | aac | gta | aaa | gtc | gcc | gtc | ctg | gat | aca | gga | atc | caa | gct | tct | cat | 432  |
| Ala | Asn | Val | Lys | Val | Ala | Val | Leu | Asp | Thr | Gly | Ile | Gln | Ala | Ser | His |      |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |      |
| ccg | gac | ttg | aac | gta | gtc | ggc | gga | gca | agc | ttc | gta | gct | ggc | gaa | gct | 480  |
| Pro | Asp | Leu | Asn | Val | Val | Gly | Gly | Ala | Ser | Phe | Val | Ala | Gly | Glu | Ala |      |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |      |
| tat | aac | acc | gac | ggc | aac | gga | cac | ggc | acg | cat | gtt | gcc | ggt | aca | gta | 528  |
| Tyr | Asn | Thr | Asp | Gly | Asn | Gly | His | Gly | Thr | His | Val | Ala | Gly | Thr | Val |      |
|     |     |     | 165 |     |     |     |     | 170 |     |     |     |     | 175 |     |     |      |
| gct | gcg | ctt | gac | aat | aca | acg | ggt | gta | tta | ggc | gtt | gcg | ccg | aac | gta | 576  |
| Ala | Ala | Leu | Asp | Asn | Thr | Thr | Gly | Val | Leu | Gly | Val | Ala | Pro | Asn | Val |      |
|     |     |     | 180 |     |     |     | 185 |     |     |     |     |     | 190 |     |     |      |
| tcc | ttg | tac | gcg | gtt | aaa | gtg | ctg | aat | tca | agc | gga | agc | gga | tct | tac | 624  |
| Ser | Leu | Tyr | Ala | Val | Lys | Val | Leu | Asn | Ser | Ser | Gly | Ser | Gly | Ser | Tyr |      |
|     |     | 195 |     |     |     |     | 200 |     |     |     |     | 205 |     |     |     |      |
| agc | ggc | att | gta | agc | gga | atc | gag | tgg | gcg | acg | aca | aac | ggc | atg | gat | 672  |
| Ser | Gly | Ile | Val | Ser | Gly | Ile | Glu | Trp | Ala | Thr | Thr | Asn | Gly | Met | Asp |      |
|     | 210 |     |     |     |     | 215 |     |     |     |     | 220 |     |     |     |     |      |
| gtt | atc | aac | atg | agc | ctt | gga | gga | cca | tca | ggc | tca | aca | gcg | atg | aaa | 720  |
| Val | Ile | Asn | Met | Ser | Leu | Gly | Gly | Pro | Ser | Gly | Ser | Thr | Ala | Met | Lys |      |
| 225 |     |     |     |     | 230 |     |     |     |     | 235 |     |     |     |     | 240 |      |
| cag | gcg | gtt | gac | aat | gca | tat | gca | aga | ggg | gtt | gtc | gtt | gtg | gcg | gct | 768  |
| Gln | Ala | Val | Asp | Asn | Ala | Tyr | Ala | Arg | Gly | Val | Val | Val | Val | Ala | Ala |      |
|     |     |     | 245 |     |     |     |     | 250 |     |     |     |     |     | 255 |     |      |
| gct | ggg | aac | agc | gga | tct | tca | gga | aac | acg | aat | aca | atc | ggc | tat | cct | 816  |
| Ala | Gly | Asn | Ser | Gly | Ser | Ser | Gly | Asn | Thr | Asn | Thr | Ile | Gly | Tyr | Pro |      |
|     |     | 260 |     |     |     |     | 265 |     |     |     |     |     | 270 |     |     |      |
| gcg | aaa | tac | gac | tct | gtc | atc | gca | gtt | ggc | gcg | gta | gac | cct | aac | agc | 864  |
| Ala | Lys | Tyr | Asp | Ser | Val | Ile | Ala | Val | Gly | Ala | Val | Asp | Pro | Asn | Ser |      |
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |      |
| aac | aga | gct | tca | ttt | tcc | agc | gtc | gga | gca | gag | ctt | gaa | gtc | atg | gct | 912  |
| Asn | Arg | Ala | Ser | Phe | Ser | Ser | Val | Gly | Ala | Glu | Leu | Glu | Val | Met | Ala |      |
|     | 290 |     |     |     |     | 295 |     |     |     |     | 300 |     |     |     |     |      |
| cct | ggc | gca | ggc | gtg | tac | agc | act | tac | cca | acc | agc | act | tat | gca | aca | 960  |
| Pro | Gly | Ala | Gly | Val | Tyr | Ser | Thr | Tyr | Pro | Thr | Ser | Thr | Tyr | Ala | Thr |      |
| 305 |     |     |     | 310 |     |     |     |     | 315 |     |     |     |     |     | 320 |      |
| ttg | aac | gga | acg | tca | atg | gct | tct | cct | cat | gta | gcg | gga | gca | gca | gct | 1008 |
| Leu | Asn | Gly | Thr | Ser | Met | Ala | Ser | Pro | His | Val | Ala | Gly | Ala | Ala | Ala |      |
|     |     |     | 325 |     |     |     |     | 330 |     |     |     |     | 335 |     |     |      |
| ttg | atc | ttg | tca | aaa | cat | ccg | aac | ctt | tca | gct | tca | caa | gtc | cgc | aac | 1056 |
| Leu | Ile | Leu | Ser | Lys | His | Pro | Asn | Leu | Ser | Ala | Ser | Gln | Val | Arg | Asn |      |
|     |     |     | 340 |     |     |     |     | 345 |     |     |     |     | 350 |     |     |      |
| cgt | ctc | tcc | agt | acg | gcg | act | tat | ttg | gga | agc | tcc | ttc | tac | tat | gga | 1104 |
| Arg | Leu | Ser | Ser | Thr | Ala | Thr | Tyr | Leu | Gly | Ser | Ser | Phe | Tyr | Tyr | Gly |      |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     | 365 |     |     |     |      |

aaa ggt ctg atc aat gtc gaa gct gcc gct caa taa  
 Lys Gly Leu Ile Asn Val Glu Ala Ala Ala Gln  
 370 375

1140

<210> 14  
 <211> 379  
 <212> PRT  
 <213> Bacillus licheniformis

<400> 14  
 Met Met Arg Lys Lys Ser Phe Trp Leu Gly Met Leu Thr Ala Leu Met  
 1 5 10 15  
 Leu Val Phe Thr Met Ala Phe Ser Asp Ser Ala Ser Ala Ala Gln Pro  
 20 25 30  
 Ala Lys Asn Val Glu Lys Asp Tyr Ile Val Gly Phe Lys Ser Gly Val  
 35 40 45  
 Lys Thr Ala Ser Val Lys Lys Asp Ile Ile Lys Glu Ser Gly Gly Lys  
 50 55 60  
 Val Asp Lys Gln Phe Arg Ile Ile Asn Ala Ala Lys Ala Lys Leu Asp  
 65 70 75 80  
 Lys Glu Ala Leu Glu Glu Val Lys Asn Asp Pro Asp Val Ala Tyr Val  
 85 90 95  
 Glu Glu Asp His Val Ala His Ala Leu Ala Gln Thr Val Pro Tyr Gly  
 100 105 110  
 Ile Pro Leu Ile Lys Ala Asp Lys Val Gln Ala Gln Gly Tyr Lys Gly  
 115 120 125  
 Ala Asn Val Lys Val Ala Val Leu Asp Thr Gly Ile Gln Ala Ser His  
 130 135 140  
 Pro Asp Leu Asn Val Val Gly Gly Ala Ser Phe Val Ala Gly Glu Ala  
 145 150 155 160  
 Tyr Asn Thr Asp Gly Asn Gly His Gly Thr His Val Ala Gly Thr Val  
 165 170 175  
 Ala Ala Leu Asp Asn Thr Thr Gly Val Leu Gly Val Ala Pro Asn Val  
 180 185 190  
 Ser Leu Tyr Ala Val Lys Val Leu Asn Ser Ser Gly Ser Gly Ser Tyr  
 195 200 205  
 Ser Gly Ile Val Ser Gly Ile Glu Trp Ala Thr Thr Asn Gly Met Asp  
 210 215 220  
 Val Ile Asn Met Ser Leu Gly Gly Pro Ser Gly Ser Thr Ala Met Lys  
 225 230 235 240  
 Gln Ala Val Asp Asn Ala Tyr Ala Arg Gly Val Val Val Val Ala Ala  
 245 250 255

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Ala Gly Asn Ser Gly Ser Ser Gly Asn Thr Asn Thr Ile Gly Tyr Pro  
 260 265 270

Ala Lys Tyr Asp Ser Val Ile Ala Val Gly Ala Val Asp Pro Asn Ser  
 275 280 285

Asn Arg Ala Ser Phe Ser Ser Val Gly Ala Glu Leu Glu Val Met Ala  
 290 295 300

Pro Gly Ala Gly Val Tyr Ser Thr Tyr Pro Thr Ser Thr Tyr Ala Thr  
 305 310 315 320

Leu Asn Gly Thr Ser Met Ala Ser Pro His Val Ala Gly Ala Ala Ala  
 325 330 335

Leu Ile Leu Ser Lys His Pro Asn Leu Ser Ala Ser Gln Val Arg Asn  
 340 345 350

Arg Leu Ser Ser Thr Ala Thr Tyr Leu Gly Ser Ser Phe Tyr Tyr Gly  
 355 360 365

Lys Gly Leu Ile Asn Val Glu Ala Ala Ala Gln  
 370 375

<210> 15  
 <211> 1146  
 <212> DNA  
 <213> Bacillus subtilis

<220>  
 <221> CDS  
 <222> (1)..(1146)

<400> 15  
 gtg aga agc aaa aaa ttg tgg atc agc ttg ttg ttt gcg tta acg tta 48  
 Val Arg Ser Lys Lys Leu Trp Ile Ser Leu Leu Phe Ala Leu Thr Leu  
 1 5 10 15  
 atc ttt acg atg gcg ttc agc aac atg tct gcg cag gct gcc gga aaa 96  
 Ile Phe Thr Met Ala Phe Ser Asn Met Ser Ala Gln Ala Ala Gly Lys  
 20 25 30  
 agc agt aca gaa aag aaa tac att gtc gga ttt aaa cag aca atg agt 144  
 Ser Ser Thr Glu Lys Lys Tyr Ile Val Gly Phe Lys Gln Thr Met Ser  
 35 40 45  
 gcc atg agt tcc gcc aag aaa aag gat gtt att tct gaa aaa ggc gga 192  
 Ala Met Ser Ser Ala Lys Lys Lys Asp Val Ile Ser Glu Lys Gly Gly  
 50 55 60  
 aag gtt caa aag caa ttt aag tat gtt aac gcg gcc gca gca aca ttg 240  
 Lys Val Gln Lys Gln Phe Lys Tyr Val Asn Ala Ala Ala Ala Thr Leu  
 65 70 75 80  
 gat gaa aaa gct gta aaa gaa ttg aaa aaa gat ccg agc gtt gca tat 288  
 Asp Glu Lys Ala Val Lys Glu Leu Lys Lys Asp Pro Ser Val Ala Tyr  
 85 90 95  
 gtg gaa gaa gat cat att gca cat gaa tat gcg caa tct gtt cct tat 336  
 Val Glu Glu Asp His Ile Ala His Glu Tyr Ala Gln Ser Val Pro Tyr  
 100 105 110  
 ggc att tct caa att aaa gcg ccg gct ctt cac tct caa ggc tac aca 384  
 Gly Ile Ser Gln Ile Lys Ala Pro Ala Leu His Ser Gln Gly Tyr Thr  
 115 120 125

|   |      |
|---|------|
| ggc tct aac gta aaa gta gct gtt atc gac agc gga att gac tct tct | 432  |
| Gly Ser Asn Val Lys Val Ala Val Ile Asp Ser Gly Ile Asp Ser Ser |      |
| 130 135 140   |      |
| cat cct gac tta aac gtc aga ggc gga gca agc ttc gta cct tct gaa | 480  |
| His Pro Asp Leu Asn Val Arg Gly Gly Ala Ser Phe Val Pro Ser Glu |      |
| 145 150 155 160   |      |
| aca aac cca tac cag gac ggc agt tct cac ggt acg cat gta gcc ggt | 528  |
| Thr Asn Pro Tyr Gln Asp Gly Ser Ser His Gly Thr His Val Ala Gly |      |
| 165 170 175   |      |
| acg att gcc gct ctt aat aac tca atc ggt gtt ctg ggc gta gcg cca | 576  |
| Thr Ile Ala Ala Leu Asn Asn Ser Ile Gly Val Leu Gly Val Ala Pro |      |
| 180 185 190   |      |
| agc gca tca tta tat gca gta aaa gtg ctt gat tca aca gga agc ggc | 624  |
| Ser Ala Ser Leu Tyr Ala Val Lys Val Leu Asp Ser Thr Gly Ser Gly |      |
| 195 200 205   |      |
| caa tat agc tgg att att aac ggc att gag tgg gcc att tcc aac aat | 672  |
| Gln Tyr Ser Trp Ile Ile Asn Gly Ile Glu Trp Ala Ile Ser Asn Asn |      |
| 210 215 220   |      |
| atg gat gtt atc aac atg agc ctt ggc gga cct act ggt tct aca gcg | 720  |
| Met Asp Val Ile Asn Met Ser Leu Gly Gly Pro Thr Gly Ser Thr Ala |      |
| 225 230 235 240   |      |
| ctg aaa aca gtc gtt gac aaa gcc gtt tcc agc ggt atc gtc gtt gct | 768  |
| Leu Lys Thr Val Val Asp Lys Ala Val Ser Ser Gly Ile Val Val Ala |      |
| 245 250 255   |      |
| gcc gca gcc gga aac gaa ggt tca tcc gga agc aca agc aca gtc ggc | 816  |
| Ala Ala Ala Gly Asn Glu Gly Ser Ser Gly Ser Thr Ser Thr Val Gly |      |
| 260 265 270   |      |
| tac cct gca aaa tat cct tct act att gca gta ggt gcg gta aac agc | 864  |
| Tyr Pro Ala Lys Tyr Pro Ser Thr Ile Ala Val Gly Ala Val Asn Ser |      |
| 275 280 285   |      |
| agc aac caa aga gct tca ttc tcc agc gca ggt tct gag ctt gat gtg | 912  |
| Ser Asn Gln Arg Ala Ser Phe Ser Ser Ala Gly Ser Glu Leu Asp Val |      |
| 290 295 300   |      |
| atg gct cct ggc gtg tcc atc caa agc aca ctt cct gga ggc act tac | 960  |
| Met Ala Pro Gly Val Ser Ile Gln Ser Thr Leu Pro Gly Gly Thr Tyr |      |
| 305 310 315 320   |      |
| ggc gct tat aac gga acg tcc atg gcg act cct cac gtt gcc cga gca | 1008 |
| Gly Ala Tyr Asn Gly Thr Ser Met Ala Thr Pro His Val Ala Arg Ala |      |
| 325 330 335   |      |
| gca gcg tta att ctt tct aag cac ccg act tgg aca aac gcg caa gtc | 1056 |
| Ala Ala Leu Ile Leu Ser Lys His Pro Thr Trp Thr Asn Ala Gln Val |      |
| 340 345 350   |      |
| cgt gat cgt tta gaa agc act gca aca tat ctt gga aac tct ttc tac | 1104 |
| Arg Asp Arg Leu Glu Ser Thr Ala Thr Tyr Leu Gly Asn Ser Phe Tyr |      |
| 355 360 365   |      |
| tat gga aaa ggg tta atc aac gta caa gca gct gca caa taa         | 1146 |
| Tyr Gly Lys Gly Leu Ile Asn Val Gln Ala Ala Ala Gln             |      |
| 370 375 380   |      |

<210> 16  
 <211> 381  
 <212> PRT  
 <213> Bacillus subtilis

<400> 16  
 Val Arg Ser Lys Lys Leu Trp Ile Ser Leu Leu Phe Ala Leu Thr Leu  
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0000180901

Ile Phe Thr Met Ala Phe Ser Asn Met Ser Ala Gln Ala Ala Gly Lys  
20 25 30

Ser Ser Thr Glu Lys Lys Tyr Ile Val Gly Phe Lys Gln Thr Met Ser  
35 40 45

Ala Met Ser Ser Ala Lys Lys Lys Asp Val Ile Ser Glu Lys Gly Gly  
50 55 60

Lys Val Gln Lys Gln Phe Lys Tyr Val Asn Ala Ala Ala Ala Thr Leu  
65 70 75 80

Asp Glu Lys Ala Val Lys Glu Leu Lys Lys Asp Pro Ser Val Ala Tyr  
85 90 95

Val Glu Glu Asp His Ile Ala His Glu Tyr Ala Gln Ser Val Pro Tyr  
100 105 110

Gly Ile Ser Gln Ile Lys Ala Pro Ala Leu His Ser Gln Gly Tyr Thr  
115 120 125

Gly Ser Asn Val Lys Val Ala Val Ile Asp Ser Gly Ile Asp Ser Ser  
130 135 140

His Pro Asp Leu Asn Val Arg Gly Gly Ala Ser Phe Val Pro Ser Glu  
145 150 155 160

Thr Asn Pro Tyr Gln Asp Gly Ser Ser His Gly Thr His Val Ala Gly  
165 170 175

Thr Ile Ala Ala Leu Asn Asn Ser Ile Gly Val Leu Gly Val Ala Pro  
180 185 190

Ser Ala Ser Leu Tyr Ala Val Lys Val Leu Asp Ser Thr Gly Ser Gly  
195 200 205

Gln Tyr Ser Trp Ile Ile Asn Gly Ile Glu Trp Ala Ile Ser Asn Asn  
210 215 220

Met Asp Val Ile Asn Met Ser Leu Gly Gly Pro Thr Gly Ser Thr Ala  
225 230 235 240

Leu Lys Thr Val Val Asp Lys Ala Val Ser Ser Gly Ile Val Val Ala  
245 250 255

Ala Ala Ala Gly Asn Glu Gly Ser Ser Gly Ser Thr Ser Thr Val Gly  
260 265 270

Tyr Pro Ala Lys Tyr Pro Ser Thr Ile Ala Val Gly Ala Val Asn Ser  
275 280 285

Ser Asn Gln Arg Ala Ser Phe Ser Ser Ala Gly Ser Glu Leu Asp Val  
290 295 300

Met Ala Pro Gly Val Ser Ile Gln Ser Thr Leu Pro Gly Gly Thr Tyr  
305 310 315 320



Gly Ala Tyr Asn Gly Thr Ser Met Ala Thr Pro His Val Ala Arg Ala  
 325 330 335

Ala Ala Leu Ile Leu Ser Lys His Pro Thr Trp Thr Asn Ala Gln Val  
 340 345 350

Arg Asp Arg Leu Glu Ser Thr Ala Thr Tyr Leu Gly Asn Ser Phe Tyr  
 355 360 365

Tyr Gly Lys Gly Leu Ile Asn Val Gln Ala Ala Ala Gln  
 370 375 380

<210> 17  
 <211> 32  
 <212> DNA  
 <213> Artificial

<220>  
 <223> Description of artificial sequence: Primer

<400> 17  
 ggaagatcta gaggttttca ccgtcatcac cg 32

<210> 18  
 <211> 34  
 <212> DNA  
 <213> Artificial

<220>  
 <223> Description of artificial sequence: Primer

<400> 18  
 ggtagatctc ttctgctgctc ttcaagaatt ccgc 34

<210> 19  
 <211> 441  
 <212> DNA  
 <213> Bacillus subtilis

<220>  
 <221> CDS  
 <222> (1)..(441)

<400> 19  
 att aaa gcg gac aaa gtg cag gct caa ggc ttt aag gga gcg aat gta 48  
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 1 5 10 15  
 aaa gta gcc gtc ctg gat aca gga atc caa gct tct cat ccg gac ttg 96  
 Lys Val Ala Val Leu Asp Thr Gly Ile Gln Ala Ser His Pro Asp Leu  
 20 25 30  
 aac gta gtc ggc gga gca agc ttt gtg gct ggc gaa gct tat aac acc 144  
 Asn Val Val Gly Gly Ala Ser Phe Val Ala Gly Glu Ala Tyr Asn Thr  
 35 40 45  
 gac ggc aac gga cac ggc gca cat gtt gcc ggt aca gta gct gcg ctt 192  
 Asp Gly Asn Gly His Gly Ala His Val Ala Gly Thr Val Ala Ala Leu  
 50 55 60

|   |     |
|---|-----|
| gac aat aca acg ggt gta tta ggc gtt gcg cca agc gta tcc ttg tac | 240 |
| Asp Asn Thr Thr Gly Val Leu Gly Val Ala Pro Ser Val Ser Leu Tyr |     |
| 65 70 75 80   |     |
| gcg gtt aaa gta ctg aat tca agc gga agc gga tca tac agc ggc att | 288 |
| Ala Val Lys Val Leu Asn Ser Ser Gly Ser Gly Ser Tyr Ser Gly Ile |     |
| 85 90 95  |     |
| gta agc gga atc gag tgg gcg aca aca aac ggc atg gat gtt atc aat | 336 |
| Val Ser Gly Ile Glu Trp Ala Thr Thr Asn Gly Met Asp Val Ile Asn |     |
| 100 105 110   |     |
| atg agc ctt ggg gga gca tca ggc tcg aca gcg atg aaa cag gca gtc | 384 |
| Met Ser Leu Gly Gly Ala Ser Gly Ser Thr Ala Met Lys Gln Ala Val |     |
| 115 120 125   |     |
| gac aat gca tat gca aaa ggg gtt gtc gtt gta gct gca gca ggg aac | 432 |
| Asp Asn Ala Tyr Ala Lys Gly Val Val Val Ala Ala Ala Gly Asn     |     |
| 130 135 140   |     |
| agc gga tct   | 441 |
| Ser Gly Ser   |     |
| 145   |     |

<210> 20  
 <211> 147  
 <212> PRT  
 <213> Bacillus subtilis

<400> 20  
 Ile Lys Ala Asp Lys Val Gln Ala Gln Gly Phe Lys Gly Ala Asn Val  
 1 5 10 15  
 Lys Val Ala Val Leu Asp Thr Gly Ile Gln Ala Ser His Pro Asp Leu  
 20 25 30  
 Asn Val Val Gly Gly Ala Ser Phe Val Ala Gly Glu Ala Tyr Asn Thr  
 35 40 45  
 Asp Gly Asn Gly His Gly Ala His Val Ala Gly Thr Val Ala Ala Leu  
 50 55 60  
 Asp Asn Thr Thr Gly Val Leu Gly Val Ala Pro Ser Val Ser Leu Tyr  
 65 70 75 80  
 Ala Val Lys Val Leu Asn Ser Ser Gly Ser Gly Ser Tyr Ser Gly Ile  
 85 90 95  
 Val Ser Gly Ile Glu Trp Ala Thr Thr Asn Gly Met Asp Val Ile Asn  
 100 105 110  
 Met Ser Leu Gly Gly Ala Ser Gly Ser Thr Ala Met Lys Gln Ala Val  
 115 120 125  
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 Ser Gly Ser  
 145

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<213> Bacillus subtilis

<220>

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<400> 21

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| att | aaa | gcg | ccg | gct | ctt | cac | tct | caa | ggc | tac | aca | ggt | tct | aac | gta | 48  |
| Ile | Lys | Ala | Pro | Ala | Leu | His | Ser | Gln | Gly | Tyr | Thr | Gly | Ser | Asn | Val |     |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |     |
| aaa | gta | gcc | gta | att | gac | agc | gga | att | gac | tct | tct | cat | cct | gac | ttg | 96  |
| Lys | Val | Ala | Val | Ile | Asp | Ser | Gly | Ile | Asp | Ser | Ser | His | Pro | Asp | Leu |     |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     |     | 30  |     |     |
| aac | gtc | aga | ggc | gga | gca | agc | ttc | gta | cct | tct | gaa | aca | aac | cca | tac | 144 |
| Asn | Val | Arg | Gly | Gly | Ala | Ser | Phe | Val | Pro | Ser | Glu | Thr | Asn | Pro | Tyr |     |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |     |
| caa | gat | ggc | agt | tct | cac | ggc | aca | cat | gta | gcc | ggt | acg | gtt | gcc | gca | 192 |
| Gln | Asp | Gly | Ser | Ser | His | Gly | Thr | His | Val | Ala | Gly | Thr | Val | Ala | Ala |     |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |     |
| ctt | aat | aac | tca | atc | ggc | gtt | ttg | ggc | gta | gcg | cca | aac | gca | tcg | tta | 240 |
| Leu | Asn | Asn | Ser | Ile | Gly | Val | Leu | Gly | Val | Ala | Pro | Asn | Ala | Ser | Leu |     |
| 65  |     |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |     |
| tat | gca | gta | aaa | gtt | ctt | gat | tca | aca | gga | aac | ggc | caa | tac | agc | tgg | 288 |
| Tyr | Ala | Val | Lys | Val | Leu | Asp | Ser | Thr | Gly | Asn | Gly | Gln | Tyr | Ser | Trp |     |
|     |     |     | 85  |     |     |     |     |     | 90  |     |     |     |     | 95  |     |     |
| att | att | aac | ggc | att | gag | tgg | gcc | att | tcc | aac | aaa | atg | gac | gtg | att | 336 |
| Ile | Ile | Asn | Gly | Ile | Glu | Trp | Ala | Ile | Ser | Asn | Lys | Met | Asp | Val | Ile |     |
|     |     | 100 |     |     |     |     |     | 105 |     |     |     |     |     | 110 |     |     |
| aac | atg | agc | ctt | ggc | gga | cct | tct | ggc | tct | aca | gct | ttg | aaa | tca | gtc | 384 |
| Asn | Met | Ser | Leu | Gly | Gly | Pro | Ser | Gly | Ser | Thr | Ala | Leu | Lys | Ser | Val |     |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |     |
| gtt | gat | aga | gcc | gta | gcc | agc | ggc | atc | gtc | gtt | gtt | gct | gca | gcc | gga | 432 |
| Val | Asp | Arg | Ala | Val | Ala | Ser | Gly | Ile | Val | Val | Val | Ala | Ala | Ala | Gly |     |
|     | 130 |     |     |     |     | 135 |     |     |     |     | 140 |     |     |     |     |     |
| aat | gaa | ggc | act | tcc | gga | agc | tca | agc | aca | atc | ggc | tat | cct | gca | aaa | 480 |
| Asn | Glu | Gly | Thr | Ser | Gly | Ser | Ser | Ser | Thr | Ile | Gly | Tyr | Pro | Ala | Lys |     |
| 145 |     |     |     |     | 150 |     |     |     |     | 155 |     |     |     |     | 160 |     |
| tat | cct | tct | acc | att | gcg | gta | ggc | gcg | gta | aac | agc | agc | aac | caa | aga | 528 |
| Tyr | Pro | Ser | Thr | Ile | Ala | Val | Gly | Ala | Val | Asn | Ser | Ser | Asn | Gln | Arg |     |
|     |     |     | 165 |     |     |     |     |     | 170 |     |     |     |     | 175 |     |     |
| ggc | tca | ttc | tca | agc | gta | ggc | cct | gag | ctt | gaa | gtc | atg | gct | cct | ggc | 576 |
| Gly | Ser | Phe | Ser | Ser | Val | Gly | Pro | Glu | Leu | Glu | Val | Met | Ala | Pro | Gly |     |
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<210> 22

<211> 192

<212> PRT

<213> Bacillus subtilis

<400> 22

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ile | Lys | Ala | Pro | Ala | Leu | His | Ser | Gln | Gly | Tyr | Thr | Gly | Ser | Asn | Val |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |
| Lys | Val | Ala | Val | Ile | Asp | Ser | Gly | Ile | Asp | Ser | Ser | His | Pro | Asp | Leu |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |
| Asn | Val | Arg | Gly | Gly | Ala | Ser | Phe | Val | Pro | Ser | Glu | Thr | Asn | Pro | Tyr |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Gln | Asp | Gly | Ser | Ser | His | Gly | Thr | His | Val | Ala | Gly | Thr | Val | Ala | Ala | 50  | 55  | 60  |
| Leu | Asn | Asn | Ser | Ile | Gly | Val | Leu | Gly | Val | Ala | Pro | Asn | Ala | Ser | Leu | 65  | 70  | 75  |
| Tyr | Ala | Val | Lys | Val | Leu | Asp | Ser | Thr | Gly | Asn | Gly | Gln | Tyr | Ser | Trp | 85  | 90  | 95  |
| Ile | Ile | Asn | Gly | Ile | Glu | Trp | Ala | Ile | Ser | Asn | Lys | Met | Asp | Val | Ile | 100 | 105 | 110 |
| Asn | Met | Ser | Leu | Gly | Gly | Pro | Ser | Gly | Ser | Thr | Ala | Leu | Lys | Ser | Val | 115 | 120 | 125 |
| Val | Asp | Arg | Ala | Val | Ala | Ser | Gly | Ile | Val | Val | Val | Ala | Ala | Ala | Gly | 130 | 135 | 140 |
| Asn | Glu | Gly | Thr | Ser | Gly | Ser | Ser | Ser | Thr | Ile | Gly | Tyr | Pro | Ala | Lys | 145 | 150 | 155 |
| Tyr | Pro | Ser | Thr | Ile | Ala | Val | Gly | Ala | Val | Asn | Ser | Ser | Asn | Gln | Arg | 165 | 170 | 175 |
| Gly | Ser | Phe | Ser | Ser | Val | Gly | Pro | Glu | Leu | Glu | Val | Met | Ala | Pro | Gly | 180 | 185 | 190 |

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